Using Flow Control with the HEAD Recorder

The HEAD Recorder is a data acquisition software program that features an editable Flow Control function. This function allows complex program sequences to be predefined, which can then be performed automatically. Fully automated procedures are possible as well as user interactions via dialogs and buttons. The program sequence is configured in an editor. This Application Note will help you get started using the editor[1]:

Flow Control Editor

A measurement sequence in the HEAD Recorder is defined in the Flow Control module. The default sequence includes the following elements: recording, insertion of the recording into a Pool Project of ArtemiS SUITE, incrementing the file name, and next recording. This default sequence normally runs automatically after each program start with no need for manual settings to be configured by the user.
In order to adapt the workflow to specific measurement tasks, it is possible to edit the standard program. To do so, launch the Flow Control editor via **Tools** -> **Flow Control Editor**. Upon opening, the editor window shows the default sequence **Standard prog. 1** (see figure 1).
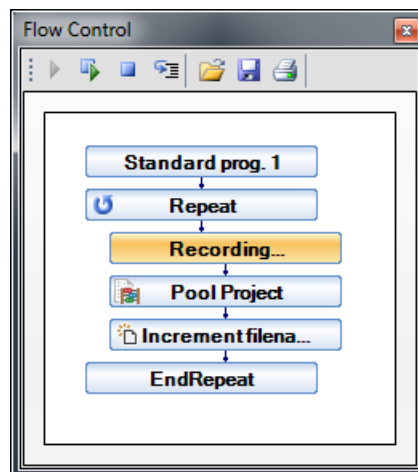

Figure 1: Flow Control Editor with the standard program

This standard program contains the elements listed above in the form of blocks: **Recording**, **Pool Project** and **Increment filename**. In order to start a new recording after these steps, the blocks are enclosed by a loop defined by the **Repeat** and **EndRepeat** blocks.
Clicking on the ▪ icon stops the program and allows it to be modified (edit mode). For this purpose, the left side of the window shows a list of all possible control blocks available for programming (see figure2).

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[1] The descriptions in this Application Note refer to version 8.2 of ArtemiS SUITE and version 8.1 of HEAD Recorder. The general proceeding applies to other versions as well. However, differences are possible in the scope of functions and in the user interface.
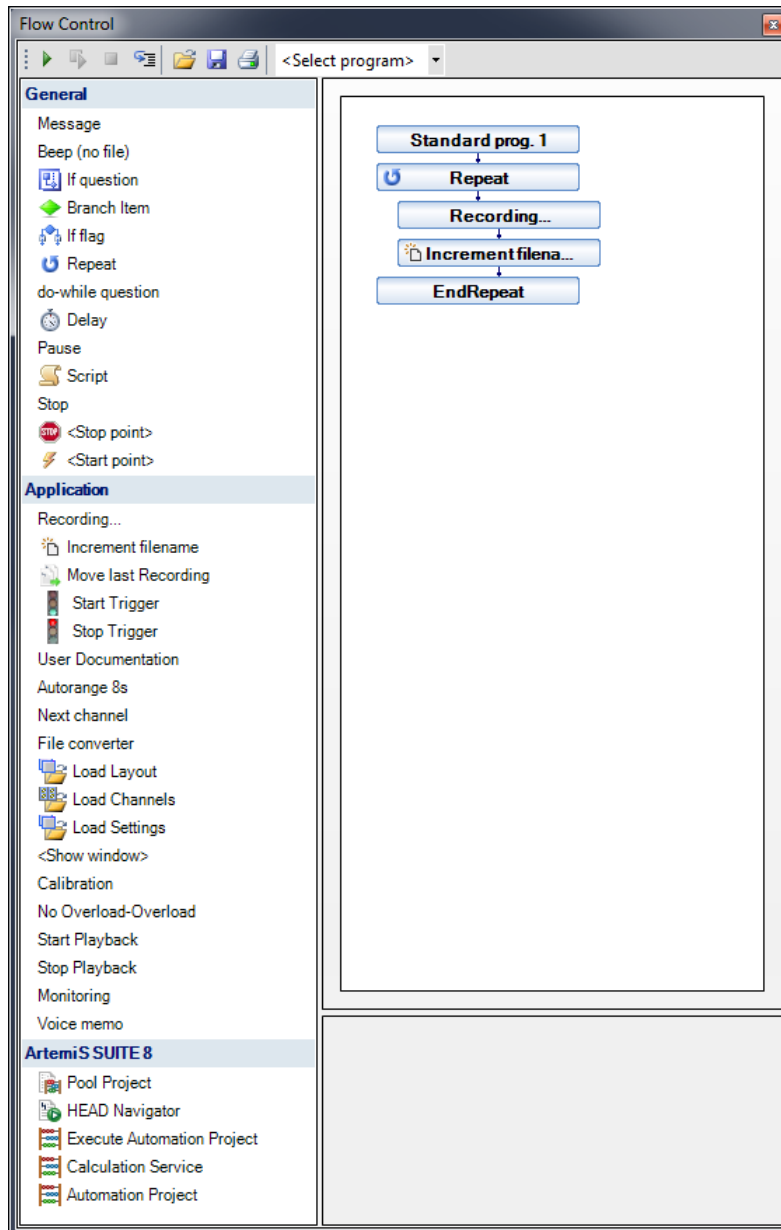
Figure 2: Flow Control in edit mode

These control blocks can be dragged with the mouse and dropped into the program sequence shown on the right side. Once a control block has been integrated into the program sequence, its properties can be edited in a properties window. The properties are displayed in the lower right area of the Flow Control window as soon as a block is clicked on with the left mouse button. A *Repeat* block, for example, allows the number of repetitions to be specified.

If you notice after starting that your program sequence contains a serious error (e.g., a faulty loop function), you can restore the standard program (default sequence) at any time via *Tool* -> *Reset Flow Control*. However, note that resetting the Flow Control deletes the entire program you created. Therefore it is advisable to save intermediate versions of your work while you are programming. To do so, click on the 🖬 icon. You can reload a saved program with the 📂 icon. The ▶ icon starts the program sequence you created.

Besides the possibility to save your Flow Control program with the 💾 icon in the editor, the current settings are also saved along with the current workspace. As soon as the workspace is reloaded when the software is started the next time, the edited Flow Control sequence is started as well.[2]

Example of how to create a custom Flow Control program

In the following, we will create an example program that controls the measurement workflow as follows: A measurement is performed, followed by a request whether the user accepts the measurement. Accepted measurements are added to a Pool Project, and after each third measurement, the calculation is started in ArtemiS SUITE. In addition to the original analysis, the results of each set of three measurements are averaged in the Pool Project.

The execution of the measurements, the addition and selection of the desired sound files, as well as the initiation of the calculation, can be performed by the Flow Control functionality in the HEAD Recorder. However, the desired analysis function, its configuration, and the averaging function must be manually added to a corresponding Pool Project in ArtemiS SUITE in advance. Figure 3 shows such a project. In the Pool Project shown below, first an FFT analysis is performed, and then the results of the analysis are averaged and displayed in a Data Viewer.
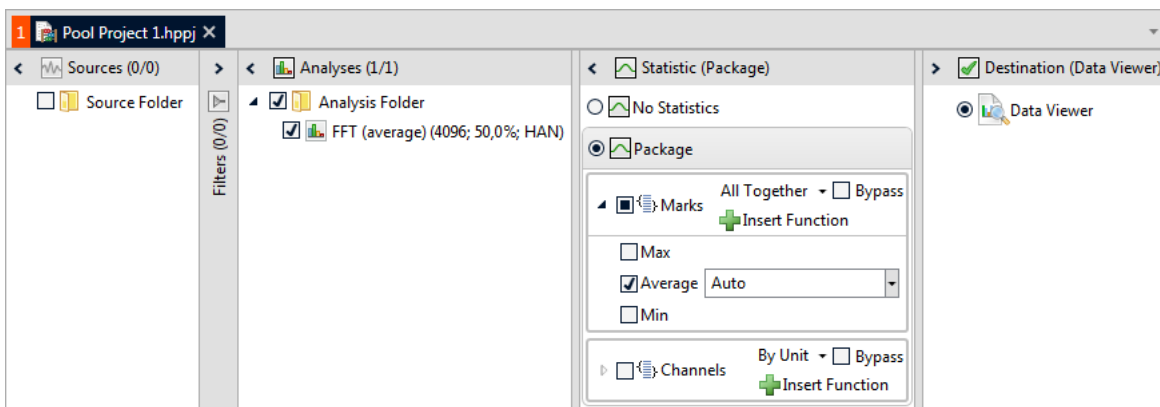

Figure 3: Example Pool Project for averaging an FFT analysis

The project shown in figure 3 is just an example for the calculations in ArtemiS SUITE. Of course, you can also use other analysis and averaging functions as well as filtering functions. This is defined by the user in the configuration of the Pool Project.

Once you have configured the Pool Project in ArtemiS SUITE according to your needs and saved it, you can launch the HEAD Recorder and open the Flow Control editor.

First, you should change the name of the program sequence and save the program: After clicking on the 💾 icon , a new name for the sequence can be entered. For consistency, it makes sense to also change the label ***Standard prog. 1*** on the top block of the program. This can be done in the properties window of this block. Click on the ***Title*** field to edit the name (see figure 4).

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[2] For this functionality, the checkbox **Tools → Options → Application → Save current settings when Recorder is closed …** must be selected.
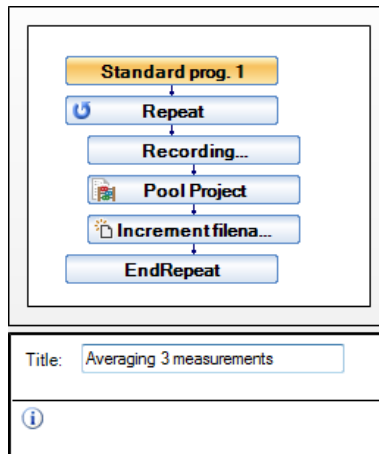
Figure 4: Changing the program title from *Standard prog. 1* to *Averaging 3 Measurements*

Afterwards, insert a new **Pool Project** block directly below this block. To do so, drag and drop this block from the selection list on the left side into the program sequence on the right side. For a correct placement, you can drag the block onto the first block. Once you release the left mouse button, the *Pool Project* block appears as a second block (see figure 5). This block will launch ArtemiS SUITE, open the project configured in advance, and disable all marks in the Source Pool.

In the properties of this block, you can first specify the Pool Project the measurements are to be added to. Click on the ⬚ button and select the desired target Pool Project. Afterwards, enable the options **Unselect marks**, **Close all currently opened Data Viewers and reports** and **Start ArtemiS SUITE if not running**. Finally, set the **Window action** to **Minimize**.
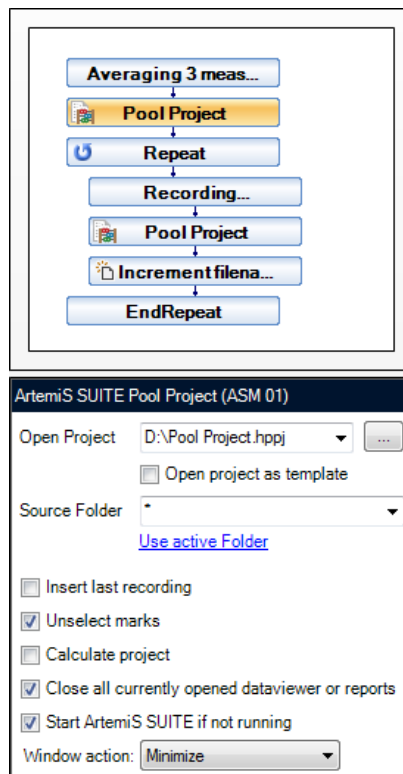

Figure 5: Properties of the *Pool Project* block

In the next step, the properties of the **Repeat** block are modified. In the default case, the **Infinitely** option is active, which causes the loop to be repeated indefinitely. To achieve a limited number of repetitions,

disable the ***Infinitely*** option and enter the desired number of repetitions in the ***Count*** field. Figure 6 shows the modified properties of the ***Repeat*** block.
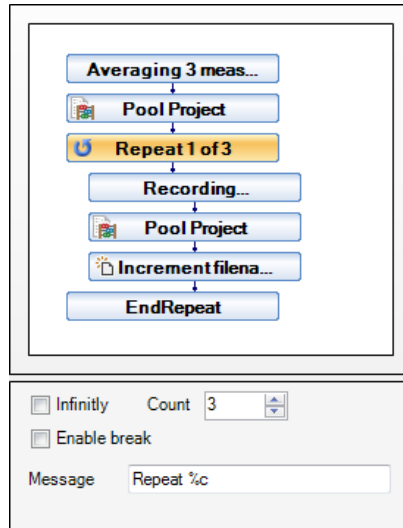

Figure 6: Modified properties of the ***Repeat*** block

To implement a pop-up question window that asks the user whether he accepts the measurement, the block ***do-while question*** needs to be included into the program sequence. To do so, drag and drop this block onto the ***Repeat*** block. Once you release the left mouse button, two blocks appear in the program sequence: ***do*** and ***OK?***. These two blocks form a loop that is repeated until the pop-up questions is confirmed by the user with a click on the ***Continue*** button. In our example, we want the recording to be repeated until the user accepts it. Therefore, we must move the ***Recording*** block to a position enclosed by the ***do-OK*** loop. You can easily rearrange the order of the blocks via drag and drop. Note that a block is always placed *after* the block you drag it onto. In the properties of the ***OK*** block we can now modify the text of the pop-up window. For our example, a suitable text would be ***Measurement OK?*** with the possible answers ***Yes*** and ***No*** (see Figure 7).
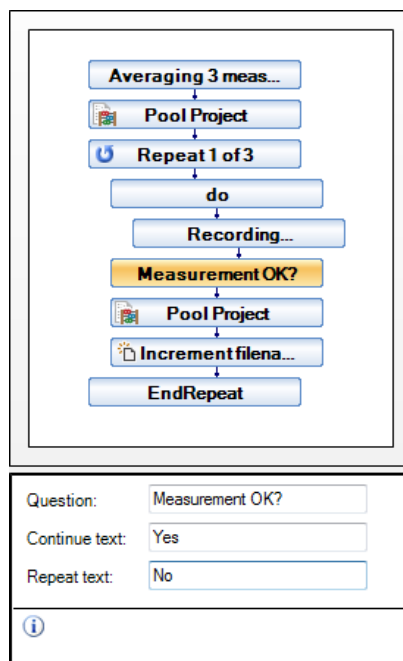

Figure 7: Question text of the ***do-while*** block

Once a recording has been accepted by the user, it should be added to the pre-configured Pool Project automatically. This function is performed by an additional Pool Project block. The default program already contains such a block, which can be reconfigured accordingly in the properties area. Since the desired Pool Project has already been opened with the first **Pool Project** block, the **Open Project** field can remain empty in this case, which automatically causes the last opened Pool Project to be used. In order to add the recordings to a Pool Project in ArtemiS SUITE without performing any other action, disable all functions except **Insert last recording** (see figure 8).
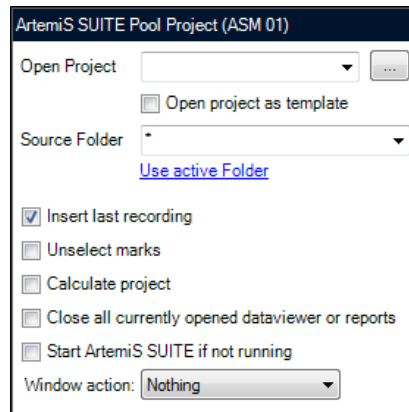

Figure 8: Properties of the second **Pool Project** block

The default program, on which this example program is based, already contains the next required block. It is the **Increment filename** block. Once a measurement has been accepted by the user and inserted into the Pool Project, the Flow Control program automatically increments a number in the file name, so a new measurement can be made and saved without overwriting the previous results. In the default settings for this block, the **Increment** option is active, which can be used for this example without modification.

The next block that follows is **EndRepeat**, which is already included in the default program as well and can be used as it is. Together with the **Repeat** block, this block defines the loop to be repeated. As soon as the **EndRepeat** block is reached, the program flow returns to the position of the **Repeat** block.

In order that ArtemiS SUITE starts the calculation defined in the preconfigured project after three measurements, another **Pool Project** block after the **EndRepeat** block is needed. This time with the **Calculate project** option enabled (see figure 9). In addition, the **Window action** parameter is set to **Bring to top** this time in order to automatically make ArtemiS SUITE window visible for viewing the calculation results.
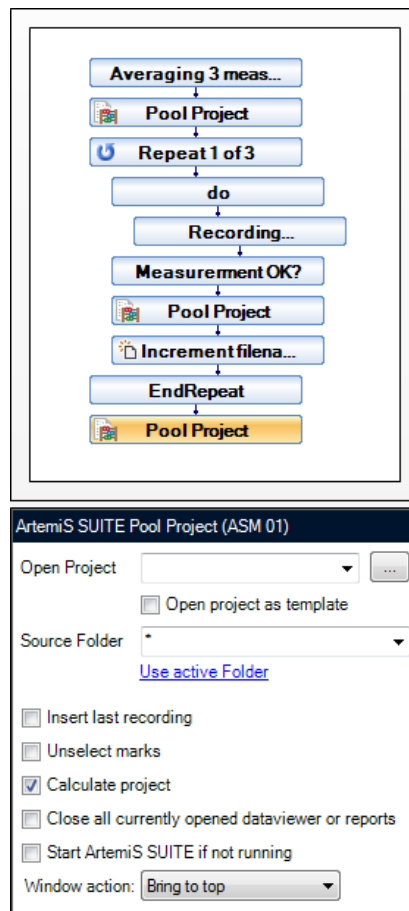
Figure 9: Properties of the *Pool Project* block that starts the calculation

Once the calculation is performed and the result is displayed, the user should be allowed to decide whether he wants to perform additional measurements. For this purpose, add an *If question* block at the end of the sequence. This block interrupts the program with a question allowing two answers. Two separate paths are assigned to the two possible answers, each of which additional blocks can be added to. In our example, the question is *Again?* with the possible answers *Yes* and *No* (see figure 10).

Figure 10: Properties of the final *If question* block

If the user clicks on *Yes*, the program is restarted from the beginning, and three new measurements can be made. In the *No* path, an additional *Stop* block has been inserted. If the user clicks on *No*, this block stops the execution and ends the Flow Control program.
After the new Flow Control program has been completed, it should first be saved by clicking on the 🖫 icon. To start the program and to use your custom Flow Control, click on the ▶ icon.
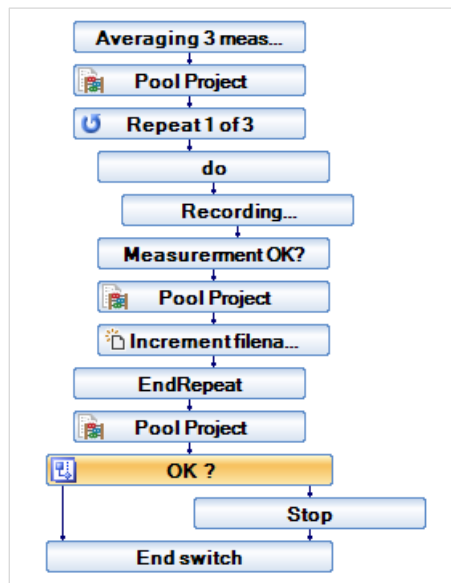Figure 11 shows the complete Flow Control program.

Figure 11: The complete Flow Control program example

Flow Control for automatic triggering of recordings

Of course, the Flow Control function can also be used to automate the recording of triggered measurements. For this purpose, the Flow Control system provides a block for the start trigger and another for the stop trigger. These blocks are labeled with green or red traffic light icons, respectively.

In the following example, we will create a Flow Control program that automatically records an engine run-up (1000 to 6000 rpm) and a coast-down (6000 to 1000 rpm). For a better overview, we will include the triggering in the standard (default) program and not in the more complex Flow Control example we created above.

To restore the default Flow Control program, you can use the command *Tools* -> *Reset Flow Control*. Before doing this, make sure to save the Flow Control program you created before.

Afterwards, the standard program can be extended with trigger blocks. To do so, first drag a **Start Trigger** block and then a **Stop Trigger** block from the block list on the left side to the Flow Control program on the right side.

In order for the triggers to be applied to the recording, the trigger blocks must be placed <u>before</u> the recording block. The order of the start and stop trigger doesn't matter. Both trigger blocks equally refer to the subsequent recording.

Afterwards, you can specify the trigger conditions in the properties. In our example, the recording is to be triggered by the left pulse channel. For the run-up, set the *Start Mode* and *Stop Mode* to *Rising Slope*. The *Trigger level* is set to *1000* (rpm) for the start trigger and *6000* (rpm) for the stop trigger. Figure 12 shows the trigger conditions for the start trigger and the stop trigger.
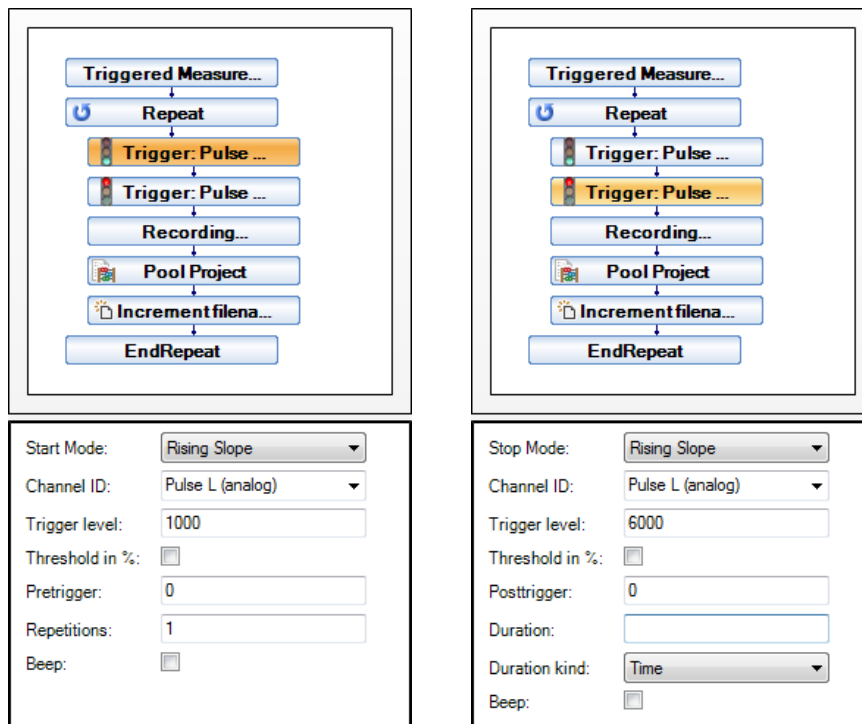
Figure 12: Trigger settings for recording a run-up

In order to record the coast-down automatically as well, the following blocks must be copied: ***Start Trigger***, ***Stop Trigger***, ***Recording***, ***Pool Project*** and ***Incrementing filename***. To copy the blocks, drag and drop them while keeping the [Ctrl] key pressed. The copied blocks must be inserted after the existing *Increment filename* block.

To start and stop the recording for the coast-down, change the trigger settings in the duplicated trigger blocks from ***Rising Slope*** to ***Falling Slope*** and the ***Trigger level*** in the start trigger block to **6000** (rpm) and in the stop trigger block to 1000 (rpm).

To record the coast-down immediately after the run-up with no need to click the record button again, you can activate the function ***Start immediately*** in the properties of the second recording block.

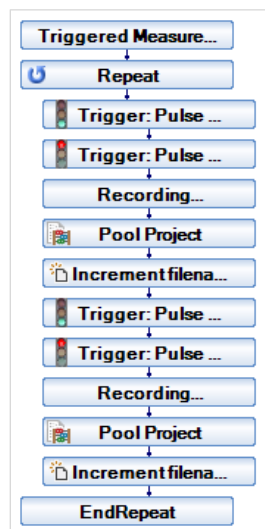The complete program with the trigger conditions for the run-down is shown in figure 13.

Figure 13: Flow Control program for recordings with automatic triggering

Once the configured Flow Control program is started with the Start button, the user needs to start the recording by clicking on the Record button. Afterwards, a run-up and a coast-down within the specified limits are recorded automatically. The recordings are added to the Source Pool of the Pool Project specified in the *Pool Project* block. Of course, it is possible to have the run-ups saved to a different folder than the run-downs. Then the file name is incremented automatically.

If you are using user documentation to document your data, it is possible to generate the file name and path from user documentation parameters, which can facilitate future evaluations. Furthermore, user documentation can be used in ArtemiS SUITE for automatic documentation in a report.[3]
Of course, the HEAD Recorder can also be used as a stand-alone application without ArtemiS SUITE. If your application does not require the recordings to be immediately added to the Source Pool of a Pool Project, you can delete the corresponding blocks.

More possibilities for using the Flow Control function as well as a detailed description of the available blocks can be found in the online help of the HEAD Recorder, which can be opened with the function key [F1].

Do you have questions for the author?
Please contact us at imke.hauswirth@head-acoustics.de.
We look forward to your feedback!

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[3] The advantages of user documentation are described in the Application Note "User documentation". The Application Note "Creating reports with user documentation and system documentation" describes how to use user documentation when creating reports.